12

Transition from the laboratory to the field and effective interplay

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Abstract

Effective interplay between laboratory and field research is dependent upon giving up scientific isolationism, and demands for leadership. An effective, integrated approach has to include all entomologists, and particularly those working in disease-endemic countries (DECs).
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State of the art

Historically, biologists working with insects can be subdivided into three main groups. The first one consists of people with a mind mostly oriented towards the whole organism and/or populations. The actual 'field workers' have been, almost uniquely, recruited from this pool of entomologists who, as a rule, only want to understand and, thus, only talk to their peers within the same group. Group two is made up of researchers looking at cells and molecules. They know the general shape of the organism they're working with, as well as some related anecdotes, and again their partners in discussion are only to be found among their equals. Finally, the third cluster consists of the drosophilists. History, though, does unexpectedly choose different roads and this guild-like state of affairs, finally, has slowly but gradually started moving towards a possible merge! Entomologists from all three groups have begun understanding one another better, and this is already exemplified by the lists of co-authors of several papers, who often 'belong' to more than one of the three castes (for example, see Lanzaro et al. 1995). Assuming that this trend will continue, the crucial question is whether it can be accelerated. Ideally, at the end of the day, one would like entomologists to be in position to switch their research from the field to the laboratory or vice versa *ad libitum*, depending on the actual questions that are to be answered. Alternatively, an intensification of *bona fide* collaborations between experts in the respective fields, laboratory and field, is a *conditio sine qua non*, if modern biology is to contribute significantly to novel strategies for the control of vector-borne diseases.

The development of genetic markers based on genomic or 'quasi-genomic' approaches – e.g., microsatellites (Zheng et al. 1993; 1996), RAPDs (Randomly amplified polymorphic DNA) (Kambhampati, Black IV and Rai 1992) etc. – certainly was the major force behind the small boom in population biology of disease vectors that took place during the past decade. The ability to assess genotypes of large

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numbers of individuals in a relatively fast way, using molecular techniques, led to a speed of analysis that could not be obtained with the previously available methodology such as cytological observations (Coluzzi et al. 1979) or allozyme/isozyme-based analysis (Beebe and Cooper 2000). The recent studies performed obviously not only dealt with population biology in its 'conventional' meaning, but also encompassed evolution (Lehmann, Hawley and Collins 1996) and indirectly, to some extent, epidemiology (see Della Torre et al. 2002). Moreover, the possibility of, at last, being able to link phenotypes to actual genetic loci (see for example Zheng et al. 1997), opened up the way for the actual genomic science that culminated in the publication of the complete genomic sequence of *Anopheles gambiae* (Holt et al. 2002).

Recently, a technical, somewhat 'turn-around' trend is also being observed, at least still on the level of planning and not through publications. It is no longer often anonymous genetic markers that are used in population studies, but genes that have actually been implemented in specific interactions with disease agents, such as genes encoding proteins of the immune system. This line of research obviously also brings together scientists from both laboratory and field.

Issues and challenges

The respective research communities can best determine the individual questions that can be resolved by an effective interplay between laboratory and field research. For these collaborations to be successful, the most important condition is to keep a non-biased attitude, always allowing for input from the 'other side'. Needless to say that molecular biology, in its wide sense, is not a scientific branch whose reason of being lies in the provision of better markers. Similarly, the notion that 'bench science' by itself will supply all answers, without recognizing that in real life insects don't live in temperature- and humidity-controlled rooms comes very close to becoming a paradigm for arrogance.

There is no doubt that the big question is how to achieve a better and more efficient interaction between the scientists in the two (and why not, all three) groups mentioned in the beginning. What are, though, the practical steps that have to be taken to achieve an integration of vector biology at a practical level? The first one that comes to mind is relatively simple: if the categorization of scientists in two or three groups is also defined through the lack of cross-communication, then bringing the members of the groups together frequently should help. Holding common meetings and workshops is, perhaps, the only way to overcome the segregation of the two communities.

The second level at which this integration can be addressed is that of education and training. Although it is a fact that University curricula now tend towards an early specialization, there are still two levels at which an integration can be attained, postgraduate and postdoctoral training. This may even be the ideal level at which the new scientists should learn that cooperation between scientific areas may ease the ways leading to the desired goals. Specialized courses, therefore, could try to include an integrated curriculum, and similarly, young scientists from one field should be urged to attend courses and meetings that have an emphasis on the other. I should mention here that the highly successful, annually recurring course on the Biology of Disease Vectors (BDV) might represent the example *par excellence* of such an integrated postgraduate educational event. Though historically focused on molecular biology, notion of the importance of field-based sciences (ecology, behaviour etc.)

may gradually change the curriculum of this course over time to become more ‘balanced’.

Capacity and partnership building

Is there an issue that relates to capacity building in DECs that differentiates integration of laboratory and field research from the other topics to be discussed? I don’t believe that this is necessarily the case. Of course, having suggested two ways to achieve a better integration of the two branches of entomology, in general, I can only strongly suggest the inclusion of DEC scientists in both integrated meetings/workshops and training courses, perhaps even thinking of an affirmative-action policy.

Finally an issue that is very often addressed and that could perhaps be mentioned here, since it does indeed address crucial questions of both field and laboratory research, is that of sample collections. Several research projects include the collection of insects from the field, which are to be ‘processed’ in laboratories, often ‘molecular’ ones, located in the North. Although the scientists in DECs are usually mentioned as co-PIs, the fact remains that the role they play in these projects is often restricted to the actual specimen collection. I am absolutely convinced that laboratories in DECs can actually play a much more important role in scientific research that addresses crucial issues of their own. Equitable partnerships and two-way identification of research needs and priorities will be essential to forward the advances of novel vector control strategies to actual field implementation (Mshinda et al. 2004). Although it is a fact that financial constraints may sometimes make collaboration one-sided, care should be taken to try to integrate DEC laboratories as much as possible and have them play a more central role in entomological research.

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